

When we were children, we used to think that when we were grown up we would no longer be vulnerable. But to grow up is to accept vulnerability. . . . To be alive is to be vulnerable.

Madeleine L'Engle

Walking on Water: Reflections on Faith and Art (1980)

ALLERGIES

The New Lore of Spores

When it comes to allergies, not all fungi are created equal, according to a study by University of Cincinnati researchers published in the September 2006 issue of *Pediatric Allergy and Immunology*. Exposure to certain fungal spores can make children more susceptible to developing allergies to mold, pollen, dust mites, pet dander, or foods, the study revealed. On the other hand, exposure to other types of fungal spores may be protective.

Fungal samples were collected in 2003 and 2004 from the homes of 144 infants under age 10 months as part of the five-year

Cincinnati Childhood Allergy and Air Pollution Study, supported by the NIEHS. Fungal measurement included long-term air sampling—48 hours, compared to the 5–10 minutes typical of such studies—which improved exposure assessment. The team then analyzed the spore samples, comparing the breakout with allergy symptoms exhibited by the infants (such as sneezing and runny nose) and skin-prick tests for 17 allergens with specific fungal spore counts.

Children who were exposed to higher levels of spores from *Basidiomycota* (club fungi) and *Penicillium/Aspergillus* (whose spores are very similar) were more likely to develop multiple allergies, says coauthor Tiina Reponen, a professor in the University of Cincinnati Department of Environmental Health. Those exposed to *Basidiomycota* were more likely to exhibit allergy symptoms; those exposed to *Penicillium/Aspergillus* and *Alternaria* (one of the most common fungi in outdoor air) were more likely to have a positive skin-prick test.

Meanwhile, exposure to *Cladosporium* (a black mold) had the opposite association, with exposed children testing positive for

sensitivity to fewer allergens. This contrasts with the experience of adults, in whom *Cladosporium* has been associated with greater allergic sensitization.

The researchers did not find any correlation between the total fungi count and allergies. “The [observed] associations would have been missed if the exposure was assessed by using the total [fungal spore] count only,” Reponen says. The study indicates that the relationship between exposure to airborne fungal spores and health effects is more complicated than researchers believed.

The indoor environment is indeed complicated. According to the authors, allergens can mix with pollutants and toxicants in synergistic ways, effects that were not addressed in this study. “We believe that contrasting relationships among the various fungal genera to the health outcomes investigated in this study might actually cancel the effect that *total* concentration may have on these outcomes,” the researchers write.

Although researchers still know little about how infants develop allergies to environmental agents, the new study offers new insights into the health effects of fungi, according to Zalman Agus, associate dean of continuing medical education at the University of Pennsylvania. The study lends credence to the so-called hygiene hypothesis, which posits that an ultraclean environment may wipe out innocuous organisms and collaterally alter some parts of children’s developing immune systems.

Yet researchers don’t know how some microbes might induce a protective effect. One hypothesis is that *Cladosporium* exposure may inhibit the response of Th2 lymphocytes, white blood cells that block dangerous microbes or foreign organisms from invading the body’s cells.

Longer-term follow-up of this cohort will better elucidate the clinical implication of the findings, Reponen says. In the meantime, the researchers advise in the paper that “clinicians and researchers should be attentive to the composition of the fungal spore profile and the respective concentrations of the fungal genera present rather than the total or culturable spore count alone.” —Julie Wakefield



Fungi and future effects. Exposure to spores of certain fungi may predispose children to developing more allergies, while exposure to others, such as those of the mold *Cladosporium* (inset), may confer a protective effect, resulting in sensitivity to fewer allergens.

MEETING REPORT

Looking Hard at Early Exposures

Children's health was the focus of almost 30 different sessions at the International Conference on Environmental Epidemiology and Exposure, held 2–6 September 2006 in Paris. Exposure to environmental toxicants early in life, and even parental exposure prior to conception, may lead to metabolic effects, cardiovascular disease, and reproduc-



tive problems later in life, said researchers speaking at the meeting.

According to Germaine Buck Louis, an epidemiologist from the National Institute of Child Health and Human Development, there is scientific evidence to support a relationship between maternal and paternal exposures prior to conception and testicular dysgenesis syndrome, a collection of adverse effects in testes, as well as the less well-studied ovarian dysgenesis. Said Buck Louis, "Periconception is a vital stage for research on exposures."

George Davey-Smith, a researcher in the University of Bristol Department of Social Medicine, told plenary attendees that prenatal and early-life exposures to environmental factors such as infectious agents and tobacco smoke have been associated with effects on blood pressure, insulin resistance (possibly leading to obesity), and cardiovascular disease in adults. Smith says that so-called predictive adaptive responses—developmental "programming" in response to adverse environmental cues—may underlie some of these associations. Evolutionarily, these responses are intended prepare the developing organism for a life of hardship. For example, a mother's poor nutrition during pregnancy may "predict" a life of nutritional hardship for her fetus. The resulting changes in fetal metabolic and cardiovascular development can prove maladaptive if the child is not, in

fact, nutritionally deprived; the result can be metabolic syndrome.

In a particularly packed session on children's health and environmental chemicals, Brenda Eskenazi, a professor of epidemiology at the University of California, Berkeley, presented the as yet unpublished, compiled results of studies from three NIEHS/EPA Children's Environmental Health Centers (UC-Berkeley, Columbia University, and Mount Sinai Medical Center) that showed similar associations between exposure to organophosphate pesticides and neurodevelopmental effects. Said Eskenazi, "The children's centers have begun to come of age, and we can now reap the benefits of harmonizing the methods for our longitudinal birth cohort studies. It demonstrates the importance of conducting similar studies in different populations."

Promotion of research on how adverse environmental exposures affect children is the primary goal of a new society announced at the Paris meeting. The International Society for Children's Health and the Environment is dedicated to protecting children from adverse environmental influences—chemical, physical, biological, and social—through research, training, policy making, clinical care, and education. The society also seeks to promote children's health by enhancing the quality of their environments.

Bruce Lanphear, director of the Children's Environmental Health Center at Cincinnati Children's Hospital Medical Center, is a founding member of the new society. He said, "It has become increasingly clear that children are particularly vulnerable to numerous environmental hazards. This society is being formed to combine and enhance our efforts to protect children from these hazards." The society is currently recruiting members.

Protection of children's health is part of the basis for a joint declaration by scientists of the International Society for Environmental Epidemiology and the European Respiratory Society, presented at the meeting, which calls for European Union authorities to strengthen proposed air quality directives. Bert Brunekreef, a professor of environmental epidemiology at the University of Utrecht, said, "It is now widely recognized that the [current] levels are not completely or sufficiently protective of public health." He added that the proposals "lack teeth" because they do not include mandatory requirements for reduction of fine particle pollution, which is associated with increases in asthma attacks and decreased pulmonary function in children. The European Commission is expected to review the proposed directives on 13 October 2006. —**Kimberly Thigpen Tart**

Don't Hold Your Breath for New Inhalers

In response to a federal push to remove chlorofluorocarbons (CFCs) from asthma inhalers by December 2008, some manufacturers have already stopped production of CFC-containing inhalers and are employing a new, more environmentally friendly propellant, hydrofluoroalkane. But the new inhalers are still in short supply, and drug stores are beginning to see a shortage. Why? The new inhalers can cost up to three times more than their predecessors, and some manufacturers are reluctant to pursue the switch wholeheartedly as long as the cheaper inhalers are available. For now, some experts suggest that asthma patients rely more on preventive treatments such as corticosteroids.



A Yen for Better Farm Chemical Rules

Strict new rules for farm chemicals such as pesticides and veterinary medicines took effect in Japan on 1 June 2006. The rules establish maximum residue limits for 799 chemicals, more than triple the number previously regulated. A blanket limit of 0.01 ppm has been set for all other chemicals. The rules apply to all farm chemicals and all categories of food. Food producers and distributors, now striving to follow the regulations, are looking for ways to minimize pesticide drift from one crop to another and are setting up plans for more stringent inspection of products—even those that originate in other countries—before they hit store shelves.

Sounding Off on School Noise

Many schools use sound amplification systems to help teachers be better heard in their classrooms, but according to a policy statement issued in June 2006 by the Acoustical Society of America, such systems actually make the situation worse. Use of sound systems increases overall sound levels and may be too loud for comfortable listening. Furthermore, in many situations, amplified sound can contribute to noise in neighboring classrooms. The society says the best way to improve noisy conditions is through renovation and better design of classrooms in compliance with American National Standards Institute S12.60-2002 standards for noise control in classrooms.



REPRODUCTIVE TOXICITY

Too Much of a Good Thing?

Pregnant women are famously exhorted to faithfully take their daily prenatal vitamins, which often contain iron and other minerals. But new research suggests that a weekly iron supplement coinciding with the renewal of the small intestine's mucosal lining cells (where nutrient absorption occurs) works better than a daily supplement and prevents problems resulting from too much iron at the wrong times.

Maternal iron deficiency and anemia early in gestation can result in premature birth and low birth weight. These, in turn, can trigger further problems ranging from slow physical growth and motor development to impaired emotional control. In severe cases, both maternal and fetal survival can be threatened at or near birth. Thus, there exists a near-global public health policy of maternal iron supplementation during pregnancy.

The new study appears in the July 2006 issue of *Archives of Medical Research*. A team including nutritionist and epidemiologist Esther Casanueva of the National Institute of Perinatology Isidro Espinosa de los Reyes (INPerIER) in Mexico City and colleagues elsewhere in Mexico City and California studied 116 women receiving prenatal care at INPerIER. All had come to INPerIER for prenatal care by gestational week 20.

None of the women were anemic at that point, but 66% had low levels of ferritin (the principal form of stored iron), suggesting low iron nutritional status. Half took 60 mg of iron as ferrous

sulfate with 200 µg of folic acid and 1 µg of vitamin B₁₂ once a day; the others took double this dose once a week. The researchers checked the women's levels of hemoglobin (which transports oxygen) and ferritin every four weeks through the end of pregnancy.

More of the women taking the weekly dose were mildly anemic (with hemoglobin levels shown not to carry any risk for mothers and infants) compared with the women taking the daily dose. However, by weeks 28 to 36, women taking the daily supplement had a significantly higher prevalence of hemoconcentration, a condition defined as hemoglobin levels above 145 g/L. Ironically, both early gestational iron-deficiency anemia and hemoconcentration later in pregnancy increase the risk of premature birth and low birth weight. Thus, the researchers suggest that excess iron supplementation can cause the same problems it is supposed to correct.

Animal studies suggest that excess iron can also trigger formation of free radicals in the intestinal mucosa and other tissues, and that both iron deficiency and iron overload can damage nuclear DNA and mitochondrial DNA. This kind of damage has been implicated in cancer induction.

The intestinal mucosa is renewed every 5 to 6 days and will absorb as much iron as necessary to maintain iron balance; however, mature cells will stop absorbing iron entirely if they are flooded with it, even if there is an iron deficit. "Maintaining a high iron environment in the intestine by ingesting significantly more iron than needed every day overwhelms this safety system," says coauthor Fernando E. Viteri. A more subtly calibrated iron supplementation during pregnancy may be as effective as current public health recommendations, and perhaps safer. —**Valerie J. Brown**

EDUCATION

Standards Vary for EH Curricula

Environmental health science is getting short shrift in some K–12 schools, according to an analysis in the May 2006 *Journal of Geoscience Education*. Students in some states "study the air, water, rocks, plants, and animals, but don't study any object or process caused by humans. In other states, human–environment (H-E) interactions are shoved into all sorts of nooks and crannies

in the science standards," says lead author Kim Kastens, a senior research scientist at Lamont-Doherty Earth Observatory of Columbia University.

Kastens and Margaret Turrin, education coordinator at Lamont-Doherty, examined science education standards in 49 states (Iowa has no statewide standards), focusing on courses required for graduation. All state standards included at least minimal discussion of H-E interactions, but 15 state standards included less than 1 discussion of H-E topics a year, on average. Only 2 states averaged more than 5 discussions a year.

State curricula more often included information on how humans affect the environment than on how the environment affects humans and human society. Curricula were least likely to include information on ways the actions and decisions of individuals in their daily lives impact the environment; only 57% of state standards included such information.

The paucity of H-E information is at odds with the National Science Education Standards developed by the

NAS, says Bora Simmons, director of the National Project for Excellence in Environmental Education of the North American Association of Environmental Educators. Indeed, it counters surveys conducted by Roper Reports/NOP World for the National Environmental Education & Training Foundation showing that 95% of adults and 96% of parents support teaching children about the environment. This general support for H-E education may not be reflected in some standards because of concerns that such topics could generate controversy, says Simmons. "Many standards have not one word on global warming," adds Kastens.

Kastens and Turrin did find H-E information in standards for other disciplines including health, geography, and consumer studies. For example, in some states children are taught that recycling is healthy, says Kastens, but they don't necessarily learn the scientific reasoning behind such assertions—information that could well be taught in science class.

The analysis calls for more and better-integrated H-E education so students can build their understanding of environmentally sustainable choices and actions. Kastens says, "An education system that never asks students to think about the impact of their actions on the environment now and in the future is a flawed system." —**Kris Freeman**



Not making the grade. A study of state science education standards shows that students often are not being taught the connection between environment and health.

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ehpnet

Global Initiative on Children's Environmental Health Indicators

More than 22,000 people came together in the late summer of 2002 in Johannesburg, South Africa, for the UN World Summit on Sustainable Development. According to *Using Indicators to Measure Progress on Children's Environmental Health: A Call to Action*, a report presented at the summit, 2 million children under the age of 15 perish due to acute respiratory infections each year, diarrheal diseases cause the deaths of just under another 2 million, and more than 1 million children succumb to malaria. The majority of these disease cases are attributable to poor environmental conditions. A number of significant commitments and initiatives were agreed upon during the summit in a bid to combat these figures. One of these was the Global Initiative on Children's Environmental Health Indicators, led by the WHO and described on its website at <http://www.who.int/ceh/indicators/globinit/en/index.html>.

The initiative homepage outlines the effort's three main objectives: to formulate and advocate the use of children's environmental health indicators, to improve ways to assess children's environmental health and monitor how well interventions are working, and to work with policy makers to improve the environments where children live. This page also provides background information on how the initiative works.



The initiative will launch a series of regional pilot projects to develop children's environmental health indicators, collect data for these indicators, and use the findings to better inform policy making at all levels of government. The leaders of each regional project choose for themselves how to approach these tasks. The initiative encourages the use of low-cost approaches that take advantage of existing data and indicators, and that work toward "a more harmonized and complete assessment of the state of children's environmental health in the longer term."

A pdf version of *Using Indicators to Measure Progress on Children's Environmental Health: A Call to Action* is available for download from the site. Also accessible from the initiative homepage is an overview presentation with additional background information on the need for indicators in this area and on the information such indicators could yield. The overview presentation also looks at options that can be pursued in implementing pilot projects.

The Regional Initiatives link on the homepage takes visitors to an introduction to the seven regional pilot programs that have been set up. Many of these programs began in the past 18 months. This page describes how the pilot programs function and puts forth ideas on how they can best be managed. Clicking on a region name takes visitors to information on which agencies lead the programs, the status of the programs, and how indicators have been developed, if this has been accomplished. Related Links at the bottom of each pilot project page include lists of entities that have agreed to partner with the initiative. These include governmental agencies, international organizations such as the UN Environment Programme, NGOs, and others.

The global initiative will work to help meet the goals of another project launched at the summit, the Healthy Environments for Children Alliance. The mission of this alliance is to reduce environmental risks to children's health through education, increasing political will, mobilizing resources, and fostering focused and urgent action on this issue. —Erin E. Dooley

Blue Planet Run

In the summer of 2007 Dow Chemical and the Blue Planet Run Foundation will cosponsor the first Blue Planet Run, a worldwide relay with runners coursing across 22 countries, 24 hours a day, for more than 3 months. The aim of the run is to raise awareness of and funds for sustainable projects to provide safe drinking water for people around the world. Waterborne diseases are the single largest contributor to human sickness and health-related deaths, with more than 25,000 people falling victim to unsafe water each day.

The foundation has already funded a number of projects—40 were implemented in 8 countries in 2005. The runs are planned to be a biannual event.



Good Science for Girls

Nearly 90% of U.S. engineers are male. To help bridge this gender gap, the New Jersey Institute of Technology has developed Femme, a program of five-week summer classes to encourage girls in grades 4–9 to aspire to careers in science and engineering. For the summer of 2006 the classes focused on environmental, aeronautical, mechanical, chemical, and biomedical engineering. A related program for 9th graders, Femme Academy, consisted of intensive instruction in electrical and computer engineering. Conducted since 1981, Femme has seen nearly 70% of its alumnae study technology, science, or engineering at the college level.

A Bevy of Biodegradables

In an effort to help stem the massive stream of waste dumped into landfills, new corn-based plastic bottles have recently hit the market in Great Britain and the United States, where millions of plastic bottles are used each day. The containers remain stable on store shelves, but decompose under composting conditions; they can also be recycled. British supermarket giant Sainsbury's has also introduced biodegradable wrap and trays for organic foods, and other UK grocery chains are starting to use biodegradable films and grocery bags. Coca-Cola is looking into compostable bottles for its drinks as well, and Nestlé has come up with trays for chocolates sold in Britain that disintegrate on contact with water.

